

Private environmental consultancy reveals five genera and ten species of angiosperms new to Rio Grande do Norte state, northeastern Brazil

Edweslley Otaviano de Moura,¹ Valdeci Fontes de Sousa,² Arthur de Souza Soares,¹ Leonardo M. Versieux^{1, 2}

1 Universidade Federal do Rio Grande do Norte, Programa de Pós-Graduação em Sistemática e Evolução, Departamento de Botânica e Zoologia. Campus Universitário, Lagoa Nova, CEP: 59072-970, Natal, RN, Brazil. **2** Universidade Federal do Rio Grande do Norte, Programa de Pós-Graduação em Ciências Florestais, Escola Agrícola de Jundiaí, Distrito de Jundiaí, RN 160–km 03, CEP: 59280-000, Macaíba, RN, Brazil.

Corresponding author: Edweslley Otaviano de Moura, moura_eo@hotmail.com

Abstract

New occurrences of 10 species of angiosperms from Rio Grande do Norte state are reported. These data were collected by an environmental consultancy prior to the establishment of a wind farm. These records demonstrate the presence of knowledge gaps in the Caatinga flora of the state and show how an environmental consultancy can positively contribute towards the documentation of biodiversity in areas prior to their modification by human activities. In particular, at a time when the Brazilian Congress is discussing the elimination of environmental studies for licensing new developments, these new occurrence data highlight the importance of environmental studies.

Key words

Agenda Brasil 2015; Caatinga domain; Lei Geral do Licenciamento Ambiental; licensing ventures; PEC 65/2012; PL 3729/2004

Academic editor: Guilherme Seger | Received 7 September 2016 | Accepted 13 March 2018 | Published 6 April 2018

Citation: Moura EO, Sousa VF, Soares AS, Versieux LM (2018) Private environmental consultancy reveals five genera and ten species of angiosperms new to Rio Grande do Norte state, northeastern Brazil. Check List 14 (2): 439–451. <https://doi.org/10.15560/14.2.439>

Introduction

Brazil is a megadiverse country and has an environmental law system, which may be not fully effective in conservation (see Drummond and Barros-Plataiu 2006). Many of these laws are being subject to polemic reviews in the last few years. One example is the recent change in the Brazilian Forest Code of 1965 (Garcia et al. 2016, Souza et al. 2012), which was criticized by environmental researchers. Currently, the PEC (Proposta de Emenda à Constituição; in English, Constitutional Amendment Proposal) 65/2012 (Brasil 2016b) and the PL (Projeto de

Lei; Law Project) 3729/2004 (Brasil 2016a) are about to be approved by the Brazilian Congress. These involve polemic changes such as the elimination of environmental studies for licensing development ventures, which threatens the functionality and effectiveness of environmental laws. In this study, we (E.O. Moura, V.F. Sousa, and A.S. Soares) conducted a rapid floristic inventory in an area of dry woodland in Rio Grande do Norte, northeastern Brazil, as part of a private environmental consultancy study for the licensing of a wind farm project. Field and laboratory work allow us to identify unreported species for Rio Grande do Norte flora.

Environmental consultants may fail to accurately depict the floristic composition of an area. Generally, such studies are based on common names or by recognition of species by locals (not trained botanists), identifications using sterile specimens, and secondary bibliographic data. Versieux et al. (2011) suggested that the environmental agencies in Brazil should consider and demand more detailed inventories prior to the development of new ventures; rapid inventories may not find the local floristic variation, which might occur over short distances, and thus overlook the local flora.

Nonetheless, beyond producing reports for bureaucratic agencies and their permitting purposes, environmental consultancies can contribute to floristic knowledge and help grow herbaria collections when studies are well conducted.

The Caatinga is the only exclusively Brazilian phytogeographic domain. It occupies approximately 11% of the national territory and has great potential for the conservation of ecosystem services, for natural resources, and for bioprospecting (Brasil 2013). However, recent studies show that this domain is still floristically poorly known (e.g. Abílio 2010, Moro et al. 2014).

The Seridó region is located in the so-called Depressão Sertaneja Setentrional, an ecoregion of the Caatinga domain shared by the states of Paraíba and Rio Grande do Norte. In the Seridó, the vegetation is dominated by herbaceous plants, and the soil is superficial and susceptible to erosion (Velloso et al. 2002). This region is 1 of 4 centers of desertification in Brazil and one of the most degraded ecoregions of the Caatinga domain (Sampaio et al. 2003, Velloso et al. 2002).

Few studies describe the flora of Rio Grande do Norte. Some recent publications include new species or new occurrences (Araújo and Alves 2013, Terra-Araújo and Alves 2013, Lourenço et al. 2013, Versieux et al. 2013, Magalhães et al. 2014, Ribeiro et al. 2015, Soares et al. 2017, Versieux et al. 2017), but there is a need to improve the floristic knowledge in the whole state, and the botanical exploration of under-collected areas should be a priority. We contribute to the documentation of biodiversity in Rio Grande do Norte by adding new records of angiosperms. Our new data illustrate the importance of the environmental licensing process, in particular the gathering of biodiversity data by qualified professionals.

Methods

The Serra das Queimadas is a mountain in the municipalities of Equador (06°56' S, 036°43' W) and Parelhas (06°41' S, 036°39' W), in the Seridó Oriental microregion of Rio Grande do Norte. The mountain is in the Caatinga phytogeographical domain and has a BSh climate, according to Köppen climate classification (Peel et al. 2007). Mining and wind farms activities are important to the economy and environment in the region. Fieldwork was conducted in August 2015, in areas of Caatinga vegetation.

The specimens collected were added to the UFRN Herbarium (acronym according to Thiers 2018), Federal University of Rio Grande do Norte. Photographs are available in the online platform REFLOA (<http://ufrn.jbrj.gov.br>). We compared our specimens with other herbarium specimens and had our identifications confirmed by various specialists (see Acknowledgements). Geographic distributions were verified using specific references, experts in the taxa, and the *Flora do Brasil 2020* (2017). The maps were made using QGIS (ver. 2.14.6).

Results

This work revealed the occurrence of 10 newly recorded species of angiosperms for Rio Grande do Norte state: *Harpochilus neesianus* Mart. ex Nees, *Justicia thumbergioides* (Lindau) Leonard, *Gomphrena vaga* Mart., *Oxandra sessiliflora* R.E. Fr., *Forsteronia pubescens* A. DC., *Dasyphyllum sprengelianum* (Gardner) Cabrera, *Combretum hilarianum* D.Dietr., *Combretum monetaria* Mart., *Euphorbia phosphorea* Mart., and *Bionia pedicellata* (Benth.) L.P. Queiroz (Fig 1, 2). The genera *Oxandra*, *Harpochilus*, *Forsteronia*, *Dasyphyllum*, and *Bionia* were previously unrecorded from the state. Additionally, *Justicia thumbergioides* may also have a first record for the state of Ceará. The same is valid for *Forsteronia pubescens* in Paraíba and Pernambuco states, and for *Dasyphyllum sprengellianum* in Paraíba, and for both species of *Combretum* in Piauí state. All of them are awaiting confirmation by specialists. The new records from Rio Grande do Norte are described below.

Acanthaceae

***Harpochilus neesianus* Mart. ex Nees in Mart., Fl. bras. 9: 146, t. 24. 1847**

Figure 3A

Erect shrub ca 1.7 m high. Leaf blades 1.5–5 × 1–2 cm, oblong, elliptic, ovate to obovate, villous to tomentose, obtuse to acute at the apex, obtuse to cuneate at the base. Inflorescence an axillary thyrse; bracts linear to oblanceolate, villous; bracteoles 1 × 0.5 mm, linear, villous; calix ca 0.8–1 cm long, lacinia 1–2 cm long, lanceolate to linear, velutinous adaxially, pubescent abaxially. Corolla 7–9 cm long, greenish, pubescent, covered with glandular trichomes, upper lip 5–6 cm long, bilobed, lower lip 4.5–5.5 cm long. Capsule ca 3 cm long, glabrous.

This species is endemic to Brazil, where it is recorded for the states of Bahia, Paraíba, and Pernambuco (Profice et al. 2015). Occurs in the Caatinga and Cerrado domains, mainly in grasslands on rocky soils or reddish sandstone outcrops (Côrtes and Rapini 2013). In Rio Grande do Norte, *H. neesianus* was collected in shrubby-tree Caatinga, growing in rocky soils. It is easily recognized in the field by its habit with subquadrangular branches, decussate and membranous leaves, and its green and deeply long bilabiate corolla.

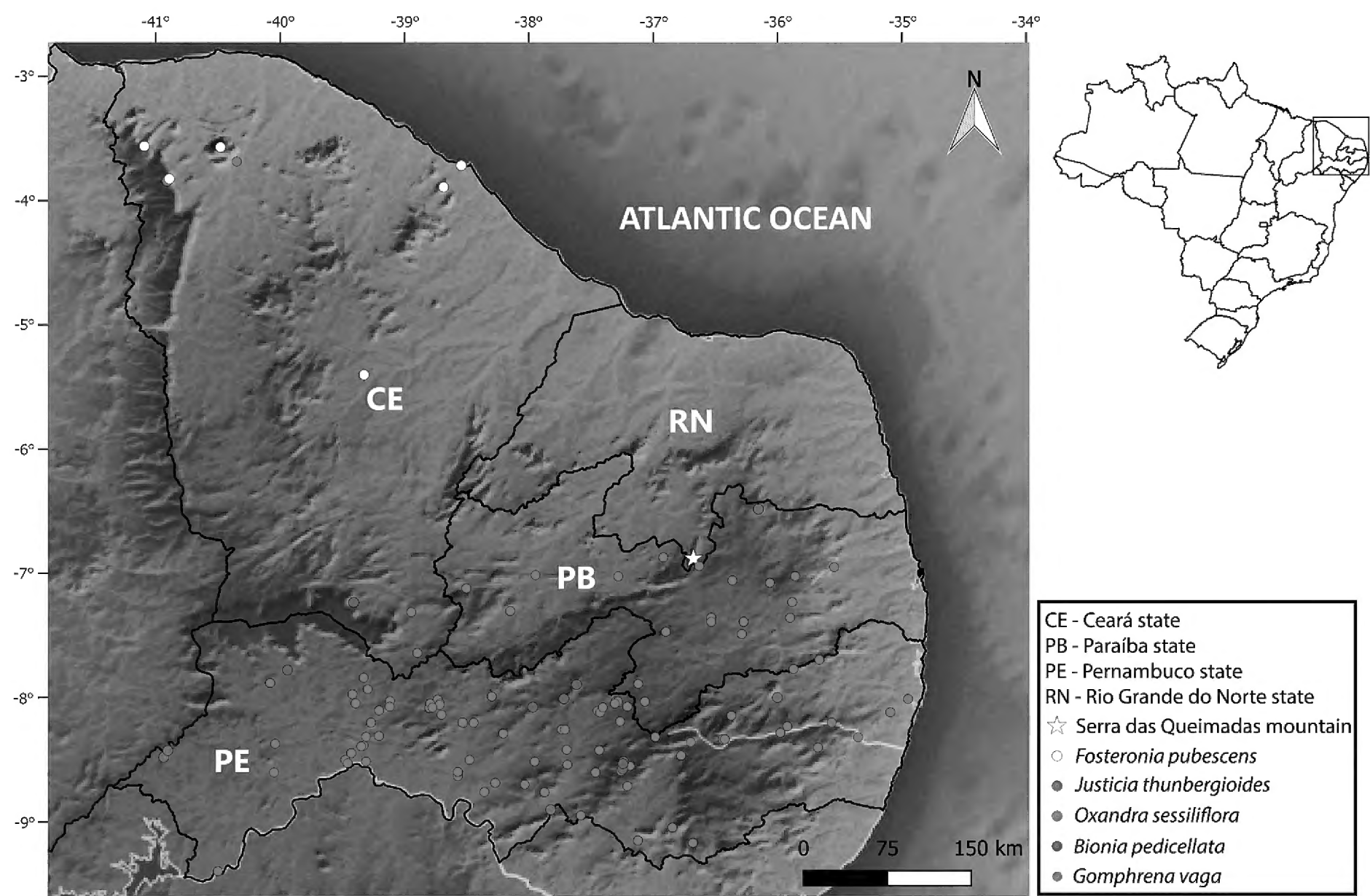


Figure 1. Nearest occurrences of the new records from Rio Grande do Norte state, northeastern Brazil.

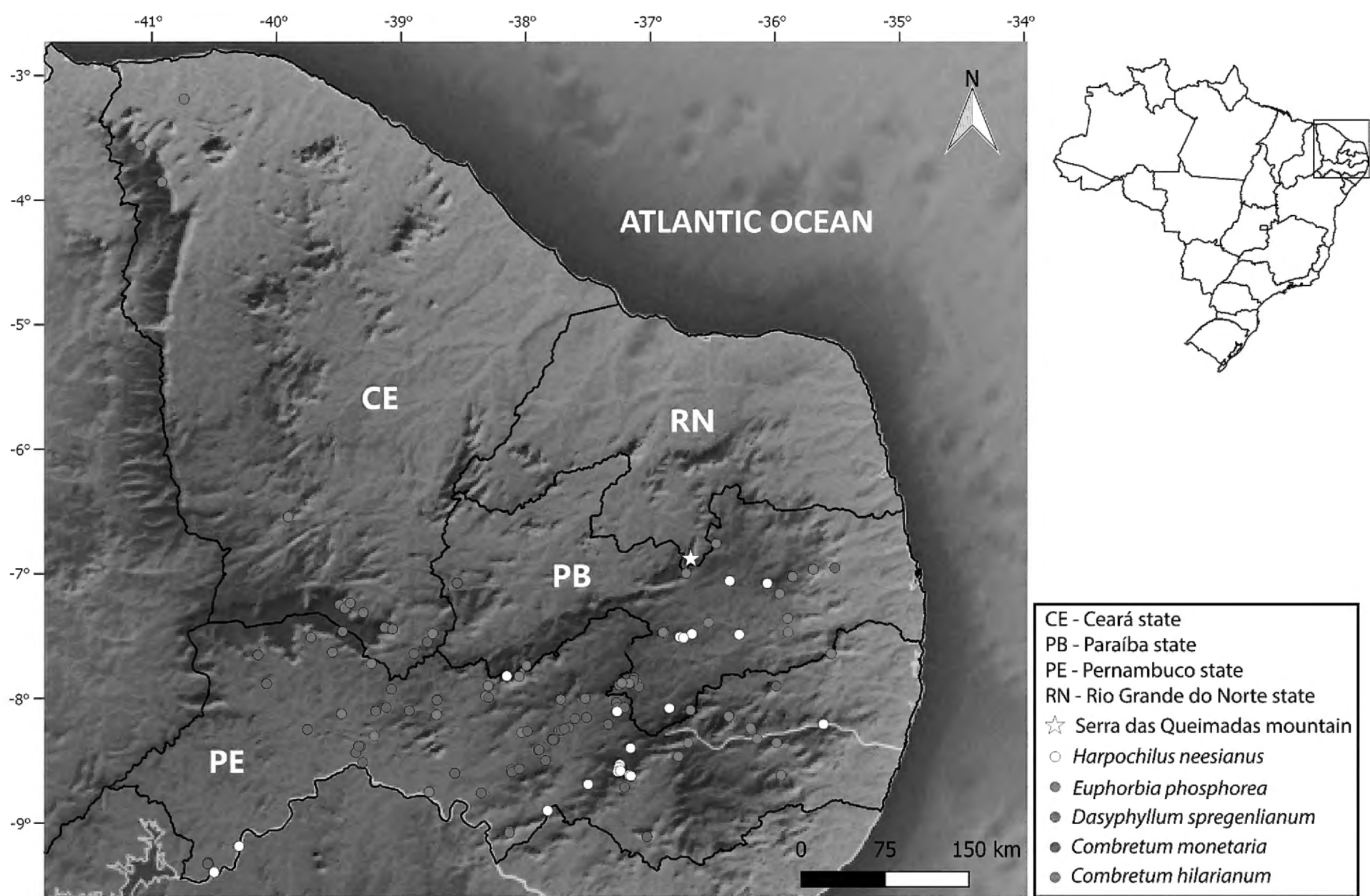


Figure 2. Nearest occurrences of the new records from Rio Grande do Norte state, northeastern Brazil.



Figure 3. **A.** Flowers of *Harpochilus neesianus* Mart. ex Nees in Martius. **B.** Flowers of *Justicia thunbergioides* (Lindau) Leonard. **C.** Inflorescence of *Dasyphyllum sprengelianum* (Gardner) Cabrera. **D.** Fruits of *Combretum hilarianum* D.Dietr. **E, F.** *Combretum monetaria* Mart.: **(E)** flowers, **(F)** fruit. **G.** Flower of *Euphorbia phosphorea* Mart. **H.** Flower of *Bionia pedicellata* (Benth.). L.P.Queiroz. Photographs: E.O. Moura (A, C, G, H) and V.F. Sousa (B, D, E, F).

Specimens examined. Brazil. Rio Grande do Norte. Equador: Serra das Queimadas, área de extração de Caulim e para instalação do Complexo Eólico Santapape, 06° 52'50" S, 036°40'31" W, fl., 12 December 2015, *Moura E.O. et al. 413* (UFRN 19560).

Additional material. Paraíba. *Agra 4146*, 07°28'59" S, 036°39'54" W (JPB 21896), *5111*, 07°28'59" S, 036°39'54" W (HUEFS 73467), *5711*, 07°28'59" S, 036°39'54" W (HUEFS 41481, JPB 30086), *5949*, 07°30'29" S, 06°45'49" W (HUEFS 73463, JPB 31000); *Barbosa 2225*, 07°30'51" S, 036°43'59" W (HUEFS 73479, JPB 29378); *Buril 262*, 07°28'59" S, 036°39'54" W (UFP 59844); *Gadelha-Neto 1437*, 08°04'45" S, 036°50'52" W (JPB 34871); *Gomes-Costa 25*, 07°29'21" S, 036°17'14" W (JPB 38408); *Miranda 1862*, 07°04'36" S, 036°03'40" W (HST 4905); *Pessoa 380*, 08°04'46" S, 036°50'52" W (JPB 39567); *Pickel 3927*, 07°03'26" S, 036°21'46" W (IPA 7104); *Vasconcelos 2242*, 07°49'15" S, 038°09'10" W (NYBG_BR 484268). **Pernambuco.** *ABC 120*, 09°23'55" S, 040°30'03" W (IPA 18981); *Andrade-Lima 71-6562*, 08°37'23" S, 037°09'21" W (IPA 25885); *Baracho 277*, 08°37'23" S, 037°09'21" W (UFP 15601); *Baracho 15601*, 08°37'23" S, 037°09'21" W (UEC 109583); *Bocage 1060*, 08°37'23" S, 037°09'21" W (HUEFS 70135), *1114*, 08°

37'23" S, 037°09'21" W (HUEFS 141039, IPA 70189); *Cano 777*, 07°28'59" S, 036°39'54" W (HUEFS 137674, IPA 82433), *789*, 08°34'58" S, 037°14'23" W (IPA 82445); *Félix s.n.*, 08°37'23" S, 037°09'21" W (HST 6281); *Figueiredo 51*, 08°37'00" S, 037°10'00" W (PEUFR 18551), *89*, 08°37'12" S, 037°10'12" W (NYBG_BR 484267, PEUFR 19221); *Fontana 6232*, 09°11'14" S, 040°18'05" W (HVASF 6446), *8063*, 09°36'01" S, 040°45'30" W (HTSA 6064); *Fotius 3375*, 09°39'17" S, 040°49'59" W (HTSA 2, IPA 31438, MAC 54290); *Gallindo 711*, 08°54'06" S, 037°49'26" W (IPA 43409); *Heringer 120*, 09°23'55" S, 040°30'03" W (UB); *Laurênio 425*, 08°37'00" S, 037°10'00" W (PEUFR 26523), *439*, 08°37'00" S, 037°10'00" W (PEUFR 26524); *Lira 4*, 08°37'00" S, 037°10'00" W (PEUFR 17113); *Machado s.n.*, 08°37'23" S, 037°09'21" W (UFP 46137); *Miranda 441*, 07°40'00" S, 042°01'00" W (HCDAL 320), *2827*, 08°37'23" S, 037°09'21" W (HST 10511, HUEFS 158835), *4477*, 08°37'23" S, 037°09'21" W (HST 12267); *Oliveira 6*, 08°37'23" S, 037°09'21" W (HST 15391, IPA 86970), *52*, 08°33'44" S, 037°15'20" W (HVASF 14148), *253*, 08°31'55" S, 037°14'42" W (HVASF 15016), *1810*, 08°41'26" S, 037°30'00" W (HVASF 18163), *6507*, 08°37'23" S, 037°09'21" W (HUEFS 226956); *Pereira*

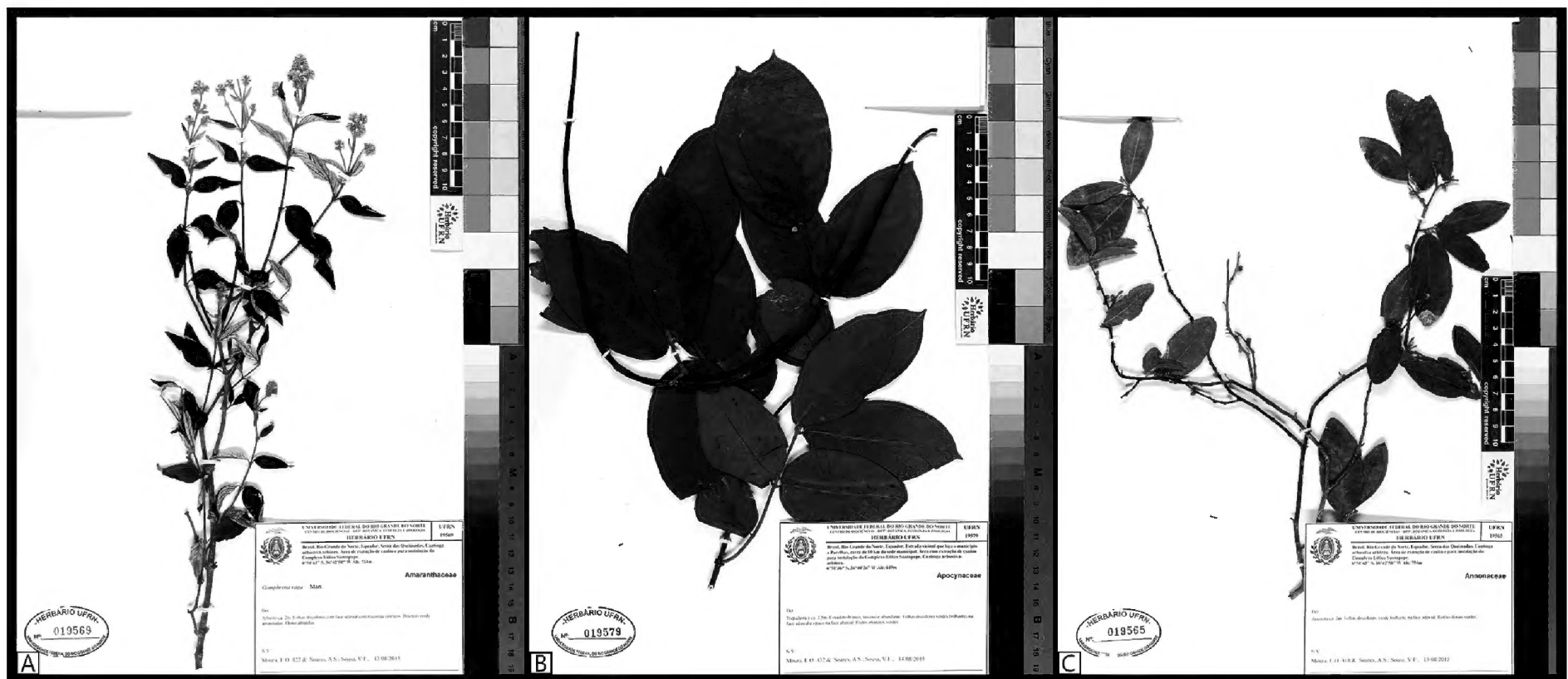


Figure 4. A. *Gomphrena vaga* Mart. B. *Forsteronia pubescens* A. DC. C. *Oxandra sessiliflora* R.E. Fr. Photographs: UFRN Herbarium.

1025, 08°37'23" S, 037°09'21" W (IPA 82702), 1040, 08°37'23" S, 037°09'21" W (IPA 82632), 2103, 08°37'23" S, 037°09'21" W (IPA 82637), 2803, 08°12'31" S, 035°36'39" W (HUEFS 149266, IPA82800); *Rocha* 1477, 08°33'18" S, 037°15'08" W (IPA 81575); *Rodal* 288, 08°37'00" S, 037°10'00" W (PEUFR 17112), 304, 08°37'00" S, 037°10'00" W (IPA 18808), 417, 08°37'00" S, 037°10'00" W (NYBG_BR 484266, PEUFR 17114); *Sales* 358, 08°37'00" S, 037°10'00" W (NYBG_BR 484265, PEUFR 17111); *Schindwein* 956, 08°37'23" S, 037°09'21" W (UFP 24484); *Silva* 1653, 08°24'00" S, 037°09'30" W (IPA 84879).

***Justicia thunbergioides* (Lindau) Leonard**, Los Angeles County Mus. Contr. Sci. 32: 10. 1959

Figure 3B

Subshrub, 1.5 m high. Leaf blade 1.5–4.5 × 0.6–1.8 cm, ovate, chartaceous, base attenuate, apex acute to attenuate. Flowers 1 or 2, axillary or terminal, sessile to subsessile; bracts 11–13 × 1–1.4 mm, lanceolate; bracteoles 6–11 × 1–1.3 mm, lanceolate, puberulous; calyx ca 1.5 cm long, 5-lobed. Corolla 2.5–3 cm long, 2-lipped, lilac, upper lip ca 1–1.3 cm long, shortly bilobed, lower lip 1.2–1.5 cm long, 3-lobed. Capsule 1–1.2 mm long, oblong. Seeds 4, suborbicular, smooth.

Justicia thunbergioides was originally described by Lindau (1905) as *Beloperone thunbergioides* and occurs in Argentina, Paraguay, Bolivia, and Brazil (Wasshausen and Wood 2004). Currently, from Brazil it is reported from the Distrito Federal and the states of Alagoas, Bahia, Pernambuco, Goiás, Mato Grosso, Mato Grosso do Sul, Minas Gerais, São Paulo (Profice et al. 2015) and Paraíba (Sousa and Versieux 2016). This species is recognized by having 1 or 2 axillary or terminal flowers, lanceolate bracts, lilac corolla with light-colored markings on lower lip, and whitish and exserted stamens. In Rio Grande do Norte, it was collected in dry forests on limestone outcrops.

Specimens examined. Brazil. Rio Grande do Norte. Equador: Serra das Queimadas, área de extração de Caulim e para instalação do Complexo Eólico Santapape, 06°51'36" S, 036°40'26" W, fl., fr, 14 August 2015, *Sousa V.F. et al.* 43 (UFRN 19953).

Additional material. **Paraíba.** *Gadelha-Neto* 2347, 08°00" S, 036°00" W (JPB 42543); **Pernambuco.** *Gomes* 55, 08°54'07" S, 037°49'26" W (NYBG_BR 492201); *Silva* 14, 08°28'43" S, 040°56'12" W (HVASF 598); *Siqueira* 1570, 08°25'32" S, 040°54'15" W (HVASF 85). It may also occur in Ceará (awaiting confirmation of herbarium material *Oliveira* 975 – HVASF 19706).

Amaranthaceae

***Gomphrena vaga* Mart.** Nov. Gen. Sp. Pl. 2: 17. 1826

Figure 4A

Scandent shrub 1–2 m high. Leaf blades 5–5.5 × 2–1.5 cm, membranous, elliptic, base cuneate, apex acute, lower surface lanuginose, upper surface strigose. Inflorescence terminal; flowers whitish-green; bracts ovate, 1–2 mm long, base truncate, apex acute; bracteoles ovate, 1–1.8 mm long, no dorsal crest, base truncate, apex acute; tepals 3.3–3.8 mm long, unequal; lacinia 3-nerved, margin entire, apex acute, entire, dorsal surface lanuginose; staminal tube ca 2.5 mm long; ovary ca 0.5 mm long, ellipsoid.

Gomphrena vaga has a wide distribution in South America (Senna et al. 2010). In Brazil, it is recorded for the Distrito Federal and the states of Alagoas, Bahia, Ceará, Maranhão, Paraíba, Pernambuco, Piauí, Sergipe, Pará, Tocantins, Goiás, Mato Grosso, Mato Grosso do Sul, Minas Gerais Rio de Janeiro, São Paulo, Paraná, Rio Grande do Sul, and Santa Catarina (Senna et al. 2015). It is easily recognized by its branched and scandent shrubby habit and leaves with lanuginose indumentum on the abaxial face. In Rio Grande do Norte, it was collected

in open areas of shrubby-tree Caatinga on stony soil.

Specimens examined. Brazil. Rio Grande do Norte. Equador: Serra das Queimadas, área de extração de Caulim e para instalação do Complexo Eólico Santapape, 06°54'43" S, 036°42'58" W, 13 August 2015, *Moura E.O. et al.* 422 (UFRN 19569); Currais Novos: BR 226, sentido Currais Novos – Santa Cruz, próximo ao km 155, 27 February 2011, *Roque A.A. et al.* 910 (UFRN 11994); Acari: Sítio Talhado, nas proximidades do km 17 da BR 427 sentido Currais Novos-Acari, 06°20'39" S, 036°36'42" W, 26 February 2011, *Costa-Lima J.L. et al.* 412 (UFRN 11581); Acari: BR 427, 16 March 2009, *Roque A.A.* 734 (UFRN 10395).

Additional material. Ceará. *Andrade* 135, 07°18'48" S, 038°56'44" W (PEUFR 50135); *Carvalho-Sobrinho* 1879, 07°38'28" S, 038°53'49" W (HVASF 3273, HUEFS 152903); *Oliveira*, 1747, 03°41'10" S, 040°20'58" W (HVASF 41347), 2149, 03°41'10" S, 040°20'58" W (MOSS 10106, UFP 42622). Paraíba. *Agra* 1273, 07°13'51" S, 035°52'52" W (JPB 18408, 18986), 1619, 07°03'26" S, 036°21'46" W (IPA 54775), 2088, 07°29'21" S, 036°17'14" W (JPB 20309, NYBG_BR 493413), 2197, 07°29'21" S, 036°17'14" W (JPB 20012), 2310, 07°01'28" S, 037°16'48" W (JPB 20451), 2361, 07°23'27" S, 036°31'58" W (FCAB 5117, IPA 54593, JPB 20013), 2535, 07°18'16" S, 038°09'01" W (FCAB 5118, IPA 54593, JPB 20630), 3093, 07°29'21" S, 036°17'14" W (JPB 21330), 3368, 07°13'51" S, 035°52'52" W (JPB23679); *Aguiar* 29, 07°23'27" S, 036°16'20" W (JPB 23840), 30, 07°23'27" S, 036°16'20" W (JPB 23846), 31, 07°23'27" S, 036°16'20" W (JPB 23847), 41, 07°23'27" S, 036°16'20" W (JPB 23839), 42, 07°23'27" S, 036°16'20" W (JPB 23842), 43, 07°23'27" S, 036°16'20" W (JPB 23844), 44, 07°23'27" S, 036°16'20" W (JPB 23843), 45, 07°23'27" S, 036°16'20" W (JPB 23841), 46, 07°23'27" S, 036°16'20" W (JPB 23845); *Andrade* 2, 07°00'52" S, 037°56'45" W (PEUFR 50169), 58, 07°07'14" S, 038°30'07" W (PEUFR 50095); *Aurino* 2, 6°56'31" S, 036°37'45" W (HUEFS 205755); *Barbosa* 2327, 07°21'29" S, 036°31'57" W (JUEFS 73473, JPB 29485); *Félix* 6550, 07°04'36" S, 036°03'40" W (PEUFR 1797); *Gadelha-Neto* 2602, 07°21'30" S, 035°53'54" W (JPB 44381); *Luetzelburg* 12212, 07°53'22" S, 037°07'12" W (IPA 39219); *Miranda* 3593, 07°01'23" S, 035°51'26" W (HUEFS 158957); *Moraes s.n.*, 07°04'37" S, 036°03'40" W (JPB 1981); 1694, 08°01'57" S, 037°04'00" W (HVASF 17779); *Vieira* 70, 07°28'14" S, 036°53'54" W (JPB 58558); *Xavier s.n.*, 06°52'20" S, 036°55'07" W (JPB 1610, 3608, 993). Pernambuco. *ABC* 479, 07°52'57" S, 040°04'54" W (IPA 19360); *Albuquerque* 294, 08°27'59" S, 036°46'33" W (UFP 24763), 302, 08°27'59" S, 036°46'33" W (UFP 24763), 303, 08°27'59" S, 036°46'33" W (UFP 24762); *Alencar* 2340, 08°37'23" S, 037°09'21" W (TEPB 30142, PACA-AGP 115816); *Almeida* 98, 08°12'14" S, 038°31'39" W (HVASF 16544), 125, 08°12'11" S, 038°26'38" W (HVASF 16571); *Alves* 35, 08°20'08" S, 036°25'27" W

(UFP 3165), 520, 08°24'05" S, 035°40'30" W (IPA 86507); *Andrade-Lima* 90, 08°20'09" S, 036°26'27" W (ASE 1958, SP 211101), 2039, 08°37'23" S, 037°09'21" W (IPA 7804); *Antunes* 37, 08°04'48" S, 037°24'19" W (HUEFS 152910, HVASF 2659); *Araújo s.n.*, 07°59'31" S, 038°17'54" W (IPA 32872), 926, 08°02'56" S, 037°18'24" W (HVASF 6493, PACA-AGP 109065), 1413, 08°18'35" S, 039°12'18" W (HVASF 8007, PACA-AGP 109066); *Ataide* 31, 07°59'31" S, 038°17'54" W (IPA 32872); *Bocage* 385, 08°07'07" S, 035°05'32" W (JPB 37227); *Burgos* 19, 9°02'45" S, 036°50'46" W (IPA 73511, JPB 37379, MAC 30632, TEPB 24766); *Cano* 809, 08°33'05" S, 037°11'10" W (HVASF 3273, IPA 82465); *Carvalho-Sobrinho* 2069, 08°12'08" S, 039°16'08" W (HVASF 3345, HUEFS 152904); *Costa* 261, 08°17'23" S, 038°12'22" W (PEUFR 43567), 358, 08°00'46" S, 034°57'01" W (PEUFR 44858); *Costa e Silva* 235, 08°36'04" S, 038°34'07" W (PEUFR 17006); *Costa-Lima* 2, 07°52'57" S, 040°04'54" W (IPA 42137), 358, 08°05'01" S, 034°57'01" W (FCAB 6910); *Cotarelli* 1128, 08°15'29" S, 037°44'03" W (HVASF 13532), 2101, 08°22'20" S, 040°02'27" W (HVASF 16419), 2391, 08°25'09" S, 037°41'44" W (HVASF 19432), 2510, 08°06'30" S, 037°26'48" W (HVASF 20037); *Fabricante* 37, 08°02'21" S, 037°16'46" W (HVASF 18903); *Fernandes* 120, 08°00'46" S, 034°57'01" W (PEUFR 44857); *Ferreira* 825, 08°36'14" S, 037°27'50" W (HVASF 16220); *Fonseca* 4, 08°19'00" S, 036°58'59" W (HUEFS 8666), *s.n.*, 08°19'00" S, 036°58'59" W (IPA 51312); *Fontana* 6146, 08°30'53" S, 037°57'08" W (HUEFS 152911, HVASF 5648, PACA-AGP 109061), 6854, 08°30'03" S, 039°28'36" W (HVASF 8620, PACA-AGP 109063), 7062, 08°01'50" S, 037°17'02" W (HVASF 9356, PACA-AGP 109063), 7914, 07°58'28" S, 039°25'08" W (HUEFS 220187); *Gomes* 8, 08°54'06" S, 037°49'26" W (FCAB 5489); *Granja* 12, 08°36'12" S, 040°03'02" W (HVASF 17470); *Griz* 6, 08°27'59" S, 036°46'33" W (IPA 60681), *s.n.*, 08°27'59" S, 036°46'33" W (UFP 11071, 14041, 14048); *Guedes* 12, 08°16'59" S, 035°58'34" W (IPA 53135), 21, 08°16'59" S, 035°58'34" W (IPA 53136); *Harley* 54173, 08°04'25" S, 037°12'24" W (INPA 220420, HUEFS 55919); *Heringer s.n.*, 07°52'57" S, 040°04'54" W (PEUFR 5144); *Lemos* 144, 09°10'11" S, 036°40'47" W (IPA 73637), 151, 09°10'11" S, 036°40'47" W (IPA 73685, JPB 37253, UFP 47960); *Lima* 90, 08°20'08" S, 036°25'27" W (BAH 4450, IPA 26170); *Maciel* 685, 08°26'50" S, 039°25'44" W (HUEFS 152909, HVASF 2751), 876, 08°07'12" S, 037°25'38" W (HVASF 19858); *Meiado* 492, 08°01'59" S, 037°18'05" W (HVASF 14830), 604, 08°06'14" S, 039°12'14" W (HVASF 19858); *Melo* 172, 08°03'00" S, 038°43'00" W (FCAB 7193), 174, 08°03'00" S, 038°43'00" W (UFP 51907); *Miranda* 2110, 07°59'31" S, 038°17'54" W (FCAB 5959, HCDAL 328, HST 6663); *Oliveira* 385, 08°34'58" S, 037°14'33" W (HVASF 15891), 1477, 08°56'56" S, 037°34'56" W (HVASF 16912), 2266, 07°50'24" S, 039°19'42" W (HVASF 19282), 2514, 08°01'02" S, 038°44'03" W (HVASF

20667), 2607, 08°11'33" S, 037°15'54" W (HVASF 20783), 2904, 08°23'10" S, 039°19'45" W (ASE 11101, IPA 84464, HVASF 2250, TEPB 23638, UFP 46682), 3040, 08°02'50" S, 039°23'39" W (HVASF 21642), 3212, 08°25'24" S, 037°26'03" W (HVASF 22131), 4531, 08°01'42" S, 039°07'00" W (HVASF 6275), 4860, 08°23'33" S, 039°20'53" W (HVASF 8370, PACA-AGP 109067), 5017, 08°45'38" S, 038°21'28" W (HVASF 9476), 5358, 08°45'45" S, 037°52'22" W (HVASF 10728, PACA-AGP 109062), 6373, 07°55'59" S, 039°17'45" W (HUEFS 227038); *Onofre* 291, 08°15'27" S, 037°42'35" W (HVASF 14632); *Pessoa* 137, 08°12'00" S, 038°32'00" W (UFP 51899); *Pick* 248, 08°35'30" S, 037°15'28" W (UFP 54289); *Pickel* 1187, 08°12'04" S, 035°33'53" W (IPA 3741); *Pimentel* 14, 08°32'26" S, 037°41'25" W (FCAB 5491, PEUFR 22002); *Pinheiro* 78, 08°03'35" S, 038°43'07" W (UFP 55338), 342, 08°05'00" S, 038°48'00" W (UFP 62810), 468, 08°08'20" S, 038°42'12" W (UFP 62833), 1211, 08°02'57" S, 038°47'36" W (JPB 55521), 1212, 08°02'57" S, 038°47'36" W (UFP 59035), 1239, 08°05'12" S, 038°48'03" W (UFP 59028), 1243, 08°04'51" S, 038°46'34" W (JPB 55525); *Ramos* 31, 07°59'31" S, 038°17'54" W (PEUFR 7693); *Reis* 16, 08°13'54" S, 035°55'13" W (PEUFR 43335); *Rocha s.n.*, 07°52'57" S, 040°04'54" W (UFP 32368); *Rodal* 626, 08°32'26" S, 037°41'25" W (PEUFR 20206, 41734); *Silva* 11, 08°28'43" S, 040°56'12" W (HVASF 595), 51, 08°41'15" S, 038°16'13" W (HUEFS 152908, HVASF 2957), 96, 08°37'59" S, 038°34'15" W (NYBG_BR 498472), 244, 08°06'08" S, 039°12'15" W (HVASF 11421); *Sobral-Leite* 1102, 08°19'12" S, 035°21'00" W (UFP 58063); *Sobrira s.n.*, 08°16'59" S, 035°58'34" W (UFP 14420); *Soldati* 57, 09°08'55" S, 037°07'20" W (PEUFR 49457), 74, 09°09'26" S, 037°20'30" W (IPA 85061, PEUFR 49471); *Souza* 2473, 09°23'55" S, 040°30'03" W (HTSA 2473); *Tschá* 113, 08°54'06" S, 037°49'26" W (FCAB 5492), 258, 08°36'00" S, 038°34'15" W (PEUFR 42408); *Viana* 71, 08°21'28" S, 036°41'47" W (IPA 68800).

Annonaceae

***Oxandra sessiliflora* R.E. Fr.**, Acta Horti Berg. 10: 172, fig. 5f, g. 1931

Figure 4B

Shrub ca 2 m high. Leaf blade 3–6.5 by 1–2.2 cm, narrowly ovate to narrowly obovate, coriaceous, smooth, base obtuse to slightly cordate, apex acute. Flowers in 1- or 2-flowered inflorescences; bracts 4 or 5, depressed ovate, 1–1.3 mm long. Flower buds globose. Fruits not seen.

Endemic species to Brazil, where it is recorded for the states of Bahia, Ceará, Maranhão, Pará, Paraíba, Piauí, Rio de Janeiro, in dry vegetation like Caatinga, Cerrado, sometimes in forest on “terra firme”, on sandy soil (Junikka et al. 2016). This species is easily recognized by its very small, bright and acute apex leaves, subsessile flowers, and the presence of a dense indument on both

young branches and petals (Junikka et al. 2016). In Rio Grande do Norte, it was collected in areas of shrubby-tree Caatinga on stony soil.

Specimens examined. Brazil. Rio Grande do Norte. Equador: Serra das Queimadas, área de extração de Caulim e para instalação do Complexo Eólico Santapape, 06°54'43" S, 036°42'58" W, fl., 13 August 2015, *Moura E.O. et al.* 418 (UFRN 19565).

Additional material. Ceará. *Loiola* 1489, 03°50'31" S, 040°54'35" W (EAC 52444).

Apocynaceae

***Forsteronia pubescens* A. DC.**, Prodr. 8: 436. 1844.

Figure 4C

Liana. Leaf blades 3.1–9.5 × 2.2–5.4 cm, elliptic, oblong, chartaceous, apex acuminate, base obtuse to rounded, pilose on both surfaces. Inflorescence thyriform, terminal; peduncle 0.5–1.2 cm long; bracts 1 mm long, ovate to lanceolate, pubescent. Flowers 3–5 mm long; pedicels 1–2 mm long; calyx-lobes 1–1.5 mm long, ovate, acute apex; corolla-lobes 3–4 mm long, white, oblong; stamen filaments 0.2–0.3 mm long, connate and agglutinated to the style, anthers wholly exserted. Follicles 15218 cm long, parallels, submoniliforms.

Forsteronia pubescens occurs in Peru, Bolivia, Paraguay, Argentina, and Brazil (Kinoshita et al. 2005). In Brazil, it is reported in Bahia, Ceará, Distrito Federal, Goiás, Mato Grosso do Sul, Mato Grosso, Paraná and in the states of Southeast Region (Koch et al. 2015). In Rio Grande do Norte it was collected in areas of shrubby-arboreal Caatinga with stony soil. This species resembles *Forsteronia thyrsoides* (Vell.) Mull. Arg. in vegetative traits. However, *F. pubescens* differs from this mainly by the color flowers (white vs greenish-yellow), bracts shape (ovate to lanceolate vs lanceolate to linear-lanceolate), calyx-lobes shape (ovate vs lanceolate), follicles position and shape (parallel and submoniliforms vs divaricate and cylindrical), and longer follicles (15–28 vs 14–15 cm). Also, it differs from *Forsteronia rufa* Mull. Arg. by calyx-lobes shape (ovate vs lanceolate), anthers position (exserted vs inserted), and follicle shape (submoniliforms vs moniliforms); from *F. velloziana* (A.DC.) Woodson it differs by calyx-lobes shape (ovate vs lanceolate), anthers position (exserted vs partially exserted), follicles position (parallel vs divaricate), and smaller follicles (15–28 vs 5–10 cm).

Specimens examined. Brazil. Rio Grande do Norte. Equador: Serra das Queimadas, área de extração de Caulim e para instalação do Complexo Eólico Santapape, 06°51'36" S, 036°40'26" W, fl., 14 August 2015, *Moura E.O. et al.* 432 (UFRN 19579).

Additional material. Ceará. *Castro* 670, 03°43'02" S, 038°32'35" W (EAC 27428), 842, 03°33'44" S, 041°05'32" W (EAC 30035); *Gardner* 1761, 05°24'10" S,

039°19'31" W (G 169308, 169309, 169310, 169311); *Guedes* 547, 03°34'12" S, 040°28'48" W (NYBG_BR 1166964); *Lima* 2407, 03°53'27" S, 038°41'08" W (PEUFR 425); *Loiola* 1751, 04°31'16" S, 041°27'22" W (EAC 1751), 2229, 03°49'28" S, 040°53'31" W (EAC 55625). It may also occur in Paraíba (awaiting confirmation of herbarium material S.C. - EAN 2043).

Asteraceae

***Dasyphyllum sprengelianum* (Gardner) Cabrera,**
Revista Mus. La Plata, Secc. Bot. 9(38): 90. 1959.

Figure 3C

Erect shrub 1–2 m high, branches glabrous, spinose, and geminate spines, straight, perpendicular to the branches. Leaf blades 2.5–6 × 1.2–2.2 cm, elliptic to lanceolate-elliptic, subcoriaceous, glabrous, 3-nerved, acute at apex or sometimes obtuse, margin entire, attenuate at base. Capitula solitary, sessile; involucre ca 2 cm long, campanulate, involucre bracts forming 8–10 whorls, margins ciliate, acute apex, external bracts ovate, internal bracts lanceolate, glabrous. Flowers yellow-light; tubular corolla ca 18 mm long, tube glabrous, lobes long setose. Cypselae 8–10 mm long, densely gray tomentose; pappus ca 15 mm long, cream colored.

Dasyphyllum sprengelianum was originally described by Gardner (1847) as *Flotovia sprengeliana* from specimens from southeastern Brazil. Its distribution ranges from Bolivia, Paraguay to Brazil (Saavedra 2011). In Brazil, it is recorded from Bahia, Ceará, Pernambuco, Piauí, Rondônia, Tocantins, Distrito Federal, Goiás, Mato Grosso, Minas Gerais and São Paulo (Saavedra 2015). In Rio Grande do Norte, *Dasyphyllum sprengelianum* was collected on shrubby Caatinga vegetation, growing in rocky soils. This species belongs to the subgenus *Dasyphyllum* section *Macrocephala* by having its 3- to 5-veined leaves from the base and anthers with a bilobed apical appendage. It resembles *D. donianum* (Gardner) Cabrera due to its subcoriaceous, glabrous, and shortly petiolate leaves, and by its bracts with hairy margins and densely villous abaxial surface. *Dasyphyllum sprengelianum* differs from *D. donianum* by the shorter spines on the branches (5–18 mm vs 20 mm long), the leaf blade acuminate at apex (vs obtuse and mucronate), and inner involucre bracts lanceolate (vs oblong-lanceolate).

Specimens examined. Brazil. Rio Grande do Norte. Equador: Serra das Queimadas, ca 10 km da sede municipal, área para implantação do Complexo Eólico Santapape, fl., fr. imat., 15 August 2015, *Soares A.S. et al.* 49 (UFRN 19535); Venha Ver: Serra de São José, 06°20'02" S, 038°28'18" W, 04 August 2010, *Roque A.A.* 838 (UFRN 10866).

Additional material. Ceará: *Castro s.n.*, 07°14'03" S, 039°24'34" W (EAC 25213); *Cavalcanti* 12, 07°14'03" S, 039°24'34" W (EAC 20327), 237, 07°14'03" S, 039°24'34" W (EAC 21956), *s.n.*, 07°14'03" S, 039°24'

34" W (EAC 25793); *Cotarelli* 1782, 07°26'40" S, 039°04'06" W (IPA 87874, HVASF 15529); *Félix s.n.*, 07°14'03" S, 039°24'34" W (EAC 18985); *Fernandes s.n.*, 07°14'03" S, 039°24'34" W (EAC 3783, 13975); *Figueiredo s.n.*, 07°14'03" S, 039°24'34" W (EAC 20044); *Fontana* 6274, 07°26'38" S, 039°04'08" W (HUNEB 14112, HVASF 6550, IPA 87876), 8484, 07°25'57" S, 039°07'54" W (HUEFS 79674); *Gardner* 1749, 05°24'10" S, 039°19'31" W (G 237609, 237610); *Gurgel* 2, 07°14'03" S, 039°24'34" W (MOSS 4857); *Lima* 333, 07°14'03" S, 039°24'34" W (IPA 49300); *Lima-Verde* 1497, 07°14'03" S, 039°24'34" W (EAC 43183), 1566, 07°14'03" S, 039°24'34" W (EAC 43184), 1580, 07°14'03" S, 039°24'34" W (EAC 43185), 1657, 07°14'03" S, 039°24'34" W (EAC 43186), 1930, 07°14'03" S, 039°24'34" W (EAC 43187), 2147, 07°14'03" S, 039°24'34" W (EAC 43188), 2232, 07°14'03" S, 039°24'34" W (EAC 43189); *Loiola* 1372, 07°14'57" S, 039°29'40" W (EAC 49842); *Mata* 2241, 07°16'27" S, 039°27'03" W (HUEFS 174523); *Miranda* 3410, 07°14'03" S, 039°24'34" W (BHCB 77655, HST 9567, HUEFS 53780), 3430, 07°14'03" S, 039°24'34" W (HST 9567, HUEFS 158958); *Morais* 127, 07°14'03" S, 039°24'34" W (IPA 90839); *Nunes s.n.*, 07°14'03" S, 039°24'34" W (EAC 16566); *Pinto* 7, 07°16'52" S, 039°27'13" W (ALCB 122257, EAC 59547); *Silva* 19, 07°14'03" S, 039°24'34" W (EAC 42982), *s.n.*, 07°18'40" S, 039°18'15" W (IPA 88333); *Sobrinho* 144, 07°14'03" S, 039°24'34" W (HST 1819, PEUFR 9334). **Pernambuco:** *Alcântara* 41, 08°37'23" S, 037°09'21" W (HST 17293, HUEFS 171971); *Andrade* 252, 08°37'30" S, 037°09'15" W (PEUFR 22628), 285, 08°37'30" S, 037°09'15" W (PEUFR 22630); *Andrade-Lima* 58-3261, 07°30'43" S, 039°43'27" W (IPA 11929, SP 211092), 61-3991, 08°37'23" S, 037°09'21" W (IPA 12913); *Cano* 730, 08°35'18" S, 037°14'28" W (HUEFS 137748, IPA 82386); *Carvalho-Sobrinho* 1781, 09°04'04" S, 038°08'04" W (HVASF 2824); *Cavalcanti* 528, 07°37'51" S, 039°33'04" W (EAC 28393); *Costa-Lima* 1864, 08°00'00" S, 037°31'27" W (HTSA 6434), 1941, 08°00'37" S, 037°43'06" W (HUEFS 220640); *Farias-Fonseca* 272, 08°37'23" S, 037°09'21" W (UFP 75154); *Fontana* 6261, 9°04'52" S, 038°08'03" W (HUNEB 14113, HVASF 6474, IPA 87878), 7013, 06°59'18" S, 038°27'37" W (HUNEB 14107, HVASF 9316, IPA 87877), 9644, 07°37'51" S, 039°33'04" W (HUEFS 226994); *Lima* 435, 07°30'43" S, 039°43'27" W (IPA 49249); *Lisboa s.n.*, 07°30'43" S, 039°43'27" W (EAC 18023); *Lopes s.n.*, 08°37'23" S, 037°09'21" W (IPA 60529, UFP 33267); *Mascena* 54C, 07°27'51" S, 039°28'13" W (EAC 59698); *Oliveira* 114, 08°34'54" S, 037°14'25" W (HVASF 14210), 5947, 08°00'36" S, 037°43'09" W (HUEFS 220702); *Rodal* 290, 08°37'00" S, 037°10'00" W (PEUFR 17328), 445, 08°37'00" S, 037°10'00" W (PEUFR 18269); *Sales* 364, 08°37'00" S, 037°10'00" W (PEUFR 18265); *Saraiva* 197, 07°30'43" S, 039°43'27" W (EAC 57560, IPA 89717, HST 20139); *Silva* 771, 08°37'00" S, 037°10'00" W (PEUFR 17774); *Silveira s.n.*, 07°37'51" S, 039°33'04" W (EAC 23056,

40398, 40399). It may also occur in Paraíba (awaiting confirmation of herbarium material *Fontana* 8619 - RB 1145629)

Combretaceae

***Combretum hilarianum* D. Dietr.**, Syn. Pl. 2: 1303.1840.

Figure 3D

Liana 3–3.5 m high, with reproductive and vegetative structures densely covered by yellow to ferruginous tomentose-villous indumentum and by a few lepidote trichomes. Leaf blades ca 7×3 cm, narrowly elliptic, acute or acuminate at the apex, cordate or obtuse at the base. Inflorescence a terminal or axillary raceme. Bracteole elliptic. Flower bud ellipsoid-rounded; lower hypanthium ca 2×1 mm, fusiform, upper hypanthium ca 1.8×2.8 mm, campanulate. Fruit orbicular, ca 1.4×1 cm, 4-winged, usually wine-red when immature.

Combretum hilarianum is a Neotropical species named by Dietrich (1840) to replace *Combretum elegans* Cambess. (1829). It distributed in Bolivia, Brazil, Paraguay, and Peru (Stace 2010). In Brazil, it is found in Bahia, Ceará, Paraíba, Pernambuco, Piauí, Acre, Pará, Rondônia, Tocantins, Distrito Federal, Goiás, Mato Grosso, Mato Grosso do Sul, Minas Gerais, and São Paulo and occurs across the Amazon, Caatinga and Cerrado domains (Marquete and Loiola 2015). In Rio Grande do Norte, it was collected in areas of shrubby Caatinga with stony soil. *Combretum hilarianum* differs from other species of *Combretum* of Rio Grande do Norte for having the lianescent habit, yellow-ferruginous tomentose-villous indumentum, besides the lepidote trichomes covering the branches, leaves, flowers, and fruits. Furthermore, during ripening, the fruits present color ranging from vinaceous to brown.

Specimens examined. Brazil. Rio Grande do Norte. Equador: Serra das Queimadas, área para instalação do Complexo Eólico Santapape, $06^{\circ}54'43''$ S, $036^{\circ}42'58''$ W, fr., 13 August 2015, *Sousa V.F. 28 et al.* (UFRN 19938).

Additional material. Ceará. *Bezerra* 545, $06^{\circ}32'31''$ S, $039^{\circ}54'24''$ W (EAC 636, JPB 43090); *Fernandes s.n.*, $03^{\circ}33'44''$ S, $041^{\circ}05'32''$ W (EAC 8281, 32507); *Oliveira* 4065, $07^{\circ}28'50''$ S, $038^{\circ}44'50''$ W (EAC 48582, HVASF 4614); *Souza* 3464, $03^{\circ}11'15''$ S, $040^{\circ}44'38''$ W (EAC 58744). Paraíba. *Andrade-Lima* 1039, $06^{\circ}57'48''$ S, $035^{\circ}41'30''$ W (ASE 1281), 78-8432, $07^{\circ}38'30''$ S, $035^{\circ}32'58''$ W (IPA 45917); *Araújo* 1381, $07^{\circ}52'36''$ S, $037^{\circ}13'42''$ W (EAC 48601, HVASF 7977), 1515, $07^{\circ}52'36''$ S, $037^{\circ}13'42''$ W (EAC 48603, HVASF 8117), 1637, $07^{\circ}50'14''$ S, $037^{\circ}07'50''$ W (EAC 48585, HVASF 8239); *Bezerra-Neta* 150, $08^{\circ}15'54''$ S, $037^{\circ}59'14''$ W (HVASF 10300); *Carvalho-Sobrinho* 2197, $07^{\circ}52'35''$ S, $037^{\circ}13'42''$ W (EAC 53633, HUEFS 152921, HVASF 4201); *Félix* 6580, $07^{\circ}04'36''$ S, $036^{\circ}03'40''$ W (HST 11018), 6596, $06^{\circ}59'48''$ S, $036^{\circ}42'47''$ W (HST 11018), 6861, $07^{\circ}04'36''$ S, $036^{\circ}03'40''$ W (EAC 51892); *Fon-*

tana 7052, $07^{\circ}52'12''$ S, $037^{\circ}06'34''$ W (EAC 53635, HVASF 9444); *Miranda* 3573, $07^{\circ}01'23''$ S, $035^{\circ}51'26''$ W (HST 13641); *Siqueira-Filho* 2187, $07^{\circ}52'30''$ S, $037^{\circ}13'44''$ W (HVASF 5081). Pernambuco. *ABC* 434, $07^{\circ}52'57''$ S, $040^{\circ}04'54''$ W (IPA 19315), 836, $08^{\circ}16'29''$ S, $038^{\circ}02'03''$ W (IPA 19785); *Alencar* 32, $07^{\circ}43'18''$ S, $039^{\circ}14'20''$ W (EAC 38998); *Félix* 7141, $07^{\circ}59'31''$ S, $038^{\circ}17'54''$ W (FCAB 5879, HST 5598); *Gomes* 207, $07^{\circ}58'59''$ S, $038^{\circ}19'16''$ W (IPA 58145); *Harley* 54121, $07^{\circ}53'57''$ S, $038^{\circ}18'09''$ W (HUEFS 55868); *Laurênio* 49, $08^{\circ}37'12''$ S, $037^{\circ}10'12''$ W (NYBG_BR 566212); *Lima s.n.*, $07^{\circ}52'57''$ S, $040^{\circ}04'54''$ W (EAC 18875); *Lucena* 686, $07^{\circ}49'26''$ S, $038^{\circ}03'15''$ W (UFP 79350), 728, $08^{\circ}21'32''$ S, $035^{\circ}59'08''$ W (UFP 81158); *Miranda* 5740, $08^{\circ}36'04''$ S, $038^{\circ}34'07''$ W (EAC 46620, HST 15858); *Pereira* 2730, $08^{\circ}37'23''$ S, $037^{\circ}09'21''$ W (HUEFS 143864, IPA 82618); *Pessoa III*, $08^{\circ}07'59''$ S, $038^{\circ}43'00''$ W (INPA 251883); *Pinheiro* 904, $08^{\circ}45'10''$ S, $038^{\circ}46'34''$ W (JPB 55503).

***Combretum monetaria* Mart.**, Flora, 24(2): Beibl. 2. 1841.

Figure 3E, F

Erect shrub or small tree 2–4 m high; branches, leaves, flower buds, flowers and fruits covered by hyaline or brown-ferruginous trichomes. Petiole 3–4 mm long; leaf blade $2-6 \times 1.7-3.0$ cm, elliptic to widely elliptic, membranous, discolored, adaxial surface dark green, abaxial surface light green, apex acute, sometimes caudate, base cuneate. Inflorescence axillary or terminal subcapitate racemes; bracteole linear to narrowly ovate; flower bud turbinate; lower hypanthium ca 2.0×0.5 mm, ovoid; upper hypanthium ca 2.5×1.8 mm, infundibular-campanulate. Fruit elliptic to widely elliptic, ca 1.4×0.4 mm, 4-winged, lepidote.

Combretum monetaria is endemic to Brazil, recorded for the states of Bahia, Ceará, Maranhão, Minas Gerais, Paraíba, Pernambuco, Piauí, and Goiás (Marquete and Loiola 2015) and growing in Caatinga or transitional areas, in rocky, sandy, or sandy-loamy soils (Loiola and Sales 1996). It is easily recognized by the erect shrubby or small tree habit, narrowly linear to linear bracteoles, the flowers with spatulate or obovate petals, and elliptic to widely elliptic fruits.

Specimens examined. Brazil. Rio Grande do Norte. Equador: Serra das Queimadas, área para instalação do Complexo Eólico Santapape, $06^{\circ}54'43''$ S, $036^{\circ}42'58''$ W, fr., 13 August 2015, *Sousa V.F. 17 et al.* (UFRN 19927); Parelhas: Área para instalação do Complexo Eólico Santapape, $06^{\circ}42'25''$ S, $036^{\circ}38'33''$ W, fr., 18 August 2015, *Sousa V.F. 55 et al.* (UFRN 19965); Tenente Laurentino Cruz: trilha saindo do assentamento indo à São Vicente, $06^{\circ}11'26''$ S, $036^{\circ}43'06''$ W, fr., 09 August 2014, *Macêdo B.R.M. 31, 32, 33* (UFRN); Campo Redondo: Fazenda Giromão, $06^{\circ}16'42''$ S, $036^{\circ}13'30''$ W, fr., 5 August 2010, *Roque A.A. 1088* (UFRN 10773).

Additional material. Ceará. *Carvalho-Sobrinho* 1861, 07°38'28" S, 038°53'50" W (HVASF 3256); *Cotarelli* 1725, 07°32'56" S, 038°47'27" W (HVASF 15429). **Paraíba.** *Araújo* 1385, 07°52'35" S, 037°13'42" W (EAC 48602, HVASF 7981), 1638, 07°50'14" S, 037°07' 50" W (HVASF 8240); *Carvalho-Sobrinho* 2514, 07°53'40" S, 037°15'01" W (HVASF 8288); *Lacerda* 327, 07°28'14" S, 036°53'54" W (JPB 34356), 489, 07°28'14" S, 036°53'54" W (JPB 34536), 544, 07°28'14" S, 036°53'54" W (JPB 34942); *Maciel* 1439, 07°09'02" S, 038°35'38" W (HVASF 7112); *Oliveira* 3909, 07°54'26" S, 037°05'32" W (HVASF 4458), 4846, 07°54'26" S, 037°05'32" W (HVASF 4458) **Pernambuco.** *ABC* 524, 07°52'57" S, 040°04'54" W (IPA 19406), 702, 8°04'27" S, 039°07'09" W (CEPEC 69391); *Almeida* 38, 08°24'48" S, 037°53'34" W (HVASF 14920); *Araújo* 741, 08°29'57" S, 037°50'29" W (EAC 54245, HVASF 6151), 1144, 08°07'35" S, 039°28'45" W (EAC 53618, HVASF 7831); 1615, 08°26'12" S, 039°21'52" W (HVASF 8217); *Bezerra-Neta* 112, 06°57'12" S, 035°31'13" W (HVASF 10297), 149, 08°15'54" S, 037°59'14" W (HVASF 10299); *Carvalho-Sobrinho* 2221, 08°12'36" S, 037°20'12" W (EAC 54252, HUEFS 152924, HVASF 4957); *Coelho* 110, 09°19'01" S, 040°33'01" W (HVASF 3016), 243, 09°19'47" S, 040°33'13" W (EAC 48590, HVASF 7651), 315, 08°14'48" S, 037°41'20" W (HVASF 8520); *Cotarelli* 778, 08°19'48" S, 037°47'15" W (EAC 54248, HVASF 12099), 813, 08°19'55" S, 037°47'12" W (EAC 54256, HVASF 12099), 1030, 08°02'07" S, 037°16'22" W (HVASF 12426), 1039, 08°14'11" S, 037°39'10" W (HVASF 12435), 2483, 08°35'29" S, 038°06'41" W (HVASF 19767); *Fotius* 3324, 09°23'55" S, 040°30'03" W (IPA 31415); *Heringer* 524, 07°52'58" S, 040°04'54" W (ASE 1236); *Lima* 28, 07°52'57" S, 040°04'54" W (IPA 42161); *Maciel* 833, 09°19'34" S, 040°32'55" W (HVASF 3211), 1119, 09°19'30" S, 40°32'50" W (EAC 48594); *Meiado* 461, 08°20'05" S, 037°46'50" W (HVASF 15394), 514, 08°19'48" S, 037°46'08" W (HVASF 14851), 580, 08°06'14" S, 039°12'14" W (HVASF 19838); *Oliveira* 2464, 08°00'49" S, 038°42'47" W (HVASF 20519), 2915, 08°23'10" S, 039°19'45" W (HVASF 2216), 5735, 08°20'04" S, 037°46'59" W (HVASF 11554); *Paiva s.n.*, 07°52'57" S, 040°04'54" W (HST 3418); *Rodal* 43, 08°36'04" S, 038°34'07" W (IPA 51894); *Santos s.n.*, 07°39'07" S, 040°08'56" W (EAC 59644, HST 16599); *Silva* 216, 08°06'07" S, 039°12'15" W (EAC 53620, HVASF 11390); *Souza* 132, 09°19'52" S, 040°32'47" W (HVASF 18303), 146, 09°19'54" S, 040°32'48" W (HVASF 18317).

Euphorbiaceae

***Euphorbia phosphorea* Mart.**, *Reise Bras.* 2: 612, 726. 1828.

Figure 3G

Perennial shrub 1.5–2 m high, branched; latex white and viscous; cladodes green covered by a thin layer of whit-

ish epicuticular wax, 8-costate, glabrous. Inflorescence fascicle of cyathia; bracts 2 per cyathium, broadly ovate, concave, opposite; involucre campanulate, glabrous; glands 5, narrowly elliptic in cross section, sessile; glandular appendix truncate, 2-corniculate, verrucose. Staminate flowers 1.5–2 mm long. Pistillate flowers 3–4 mm long; ovary 3 × 4 mm, rugose; 3-capellate, shortly bipartite.

Endemic to Brazil, *Euphorbia phosphorea* is recorded for Bahia, Paraíba, Pernambuco, Sergipe, and Minas Gerais (Steinmann et al. 2016). It is easily recognized in the field by the shrubby habit with costate cladodes; presence of fascicles of cyathia; pistillate flowers presenting 5 glands with a pair of truncate and corniculate appendages at the extremities. This is the first record of xeromorphic species of Euphorbiaceae for Rio Grande do Norte, it was collected as rupicolous on rocky outcrops in Caatinga. This species inhabits in Caatinga vegetation where it usually grows in deciduous forests or thorny scrubs over exposed rocky soils, gravelly sandy substrates, or on inselbergs (Riina et al. 2015).

Specimens examined. Brazil. Rio Grande do Norte: Equador: Serra das Queimadas, área de extração de Caulim e para instalação do Complexo Eólico Santapape, 06°55'10" S, 036°43'25" W, 12 July 2015, *Moura E.O. et al.* 404 (UFRN 19551); Monte das Gameleiras: afloramento às margens da RN 269, 21 December 2015, *Moura E.O. et al.* 461 (UFRN 20398).

Additional material. Paraíba. *Agra* 4145, 07°28'59" S, 036°39'54" W (JPB 20556); *Andrade-Lima* 1063, 07°21'30" S, 035°53'54" W (MAC 1968), 8630, 06°59'48" S, 036°42'47" W (IPA 45173); *Araújo* 1365, 07°52'35" S, 037°13'42" W (HVASF 7961); *Brasileiro* 17, 07°09'40" S, 035°57'38" W (UEC 158492); *Costa* 40, 07°28'14" S, 036°53'54" W (HUEFS 209549, JPB 41727), 21 (JPB 41709); *Fontana* 6566, 07°52'30" S, 037°13'44" W (HVASF 7545); *Gadelha-Neto* 1688, 06°45'28" S, 036°28'15" W (JPB 38034), 1936, 07°04'37" S, 036°03'40" W (JPB 38059), 2732, 08°05'45" S, 036°40'41" W (JPB 44413); *Lacerda* 376, 07°23'27" S, 036°31'58" W (JPB 34405); *Lima* 966, 07°28'10" S, 035°53'38" W (JPB 38742); *Lucena* 1856, 07°29'20" S, 036°17'14" W (UFP 51867); *Oliveira* 4328, 07°52'43" S, 037°10'16" W (HVASF 5944); *Schindwein* 925, 06°59'48" S, 036°42'47" W (JPB 24421). **Pernambuco:** *Araújo* 1141, 08°07'35" S, 039°28'45" W (HVASF 7828); *Davis* 61118, 08°37'00" S, 035°57'00" W (UEC 4805); *Fontana* 7039, 08°18'11" S, 039°12'59" W (HVASF 9342); *Gomes* 679, 08°15'00" S, 36°11'25" W (UFP 82831); *Krause* 111, 08°08'45" S, 036°22'16" W (PEUFR 30040), 126, 08°14'17" S, 036°11'52" W (PEUFR 30041), 151, 08°27'59" S, 036°46'33" W (PEUFR 30042); *Nascimento* 518, 08°08'45" S, 036°22'16" W (HUEFS 57060, PEUFR 36835); *Oliveira s.n.* 08°21'28" S, 036°41'47" W (UFP 41399); *Silva* 40, 08°19'33" S, 036°08'34" W (PEUFR 46106).

Fabaceae

***Bionia pedicellata* (Benth.) L.P.Queiroz**, Neodiversity 3: 17. 2008.

Figure 3H

Erect shrubs, 1–1.5 m high; stem cylindrical and greyish. Leaf blades 2.5–6 cm long, elliptic, apex retuse, base obtuse. Inflorescence nodose pseudoraceme; flowers ca 3 cm long, sessile; calyx cylindrical, lacinia triangular, corolla dialypetalous, petals unguiculate and dark red, banner ca 4 cm long, narrowly elliptic; androecium pseudomonadelphous, with 10 stamens, joined in a tube but one free at the base; ovary stipitate, oblong. Fruit a legume with elastic dehiscence. Seeds compressed, lenticular, suborbiculate.

This species was originally described by Bentham (1840) as *Camptosema pedicellatum* from specimens of northeastern Brazil, state of Ceará. *Bionia pedicellata* is endemic to northeastern Brazil and recorded for Bahia, Ceará, Pernambuco, and Piauí (Queiroz 2015). In Rio Grande do Norte, it was found in open Caatinga vegetation, growing in rocky soils. It is easily recognized in the field by its low shrubby habit, simple leaves with obtuse base and velutinous abaxial surface, by the dark red petals, and by the velutinous indumentum of its legumes.

Specimens examined. Brazil. Rio Grande do Norte. Equador: Serra das Queimadas, área para implantação do Complexo Eólico Santapape, 06°55'10" S, 036°43'25" W, fl., fr. imat., 12 August 2015, Moura E.O. et al. 411 (UFRN 19558).

Additional material. **Ceará.** Castro s.n., 07°14'03" S, 039°24'34" W (EAC 25432); Cavalcanti s.n., 07°14'03" S, 039°24'34" W (EAC 18313); Fernandes s.n., 07°14'03" S, 039°24'34" W (EAC 17970); Gardner 1552, 05°24'10" S, 039°19'31" W (G 388882, 38883); Martins s.n., 07°14'03" S, 039°24'34" W (EAC 8114); Miranda 3408, 07°14'03" S, 039°24'34" W (HST 8881, HUEFS 185175); Nunes s.n., 07°14'03" S, 039°24'34" W (EAC 16538); Souza 325, 07°14'03" S, 039°24'34" W (EAC 28283). **Pernambuco.** Alencar 2246, 08°31'56" S, 037°14'34" W (HUEFS 2061119); Coradin 2498, 07°46'42" S, 039°56'28" W (CEN 5047); Cotarelli 787, 08°00'38" S, 037°43'07" W (HVASF 12078); Félix 7454, 08°37'23" S, 037°09'21" W (HST 5387); Fontana 7112, 08°00'38" S, 037°43'07" W (HVASF 9398), 7133, 07°53'42" S, 037°37'00" W (HVASF 9418), 8365, 08°04'40" S, 037°58'01" W (HUEFS 220261); Miranda 2300, 08°37'23" S, 037°09'21" W (HST 6878) Oliveira 135, 08°30'53" S, 037°14'14" W (HVASF 14231), 332, 08°32'13" S, 037°14'31" W (HVASF 15838); Santos 1594, 08°34'33" S, 037°14'45" W (HUEFS 122531); Silva 21, 08°37'23" S, 037°09'21" W (HST 16983).

Discussion

Our new data demonstrate the importance of additional studies to better document the Caatinga flora of Rio

Grande do Norte, as well as the importance of accurate fieldwork during environmental consultancy. Although the Rio Grande do Norte has currently 1,222 cataloged species, neighboring states with similar areas and phytophysiognomies have a considerably higher number of recorded species (e.g. Paraíba, with 1,837 species of angiosperms) (BFG 2015). To illustrate this, 7 species of this study were already known from Paraíba or Ceará, suggesting that many taxa cited for neighboring states are likely for Rio Grande do Norte but not yet collected. Of the 10 new records, *Bionia pedicellata*, *Euphorbia phosphorea*, *Combretum monetaria*, and *Harpochilus neesianus* present a distributional pattern centered in northeastern Brazil, mainly in the Caatinga domain (BFG 2015). *Forsteronia pubescens*, *Dasyphyllum sprengelianum*, *Combretum hilarianum*, and *Gomphrena vaga* are Neotropical. The genus *Harpochilus* is endemic to Brazil and is represented by 2 shrub species, *H. neesianus*, restricted to the Caatinga and *H. phaeocarpus* Nees, only found in the Atlantic Forest. Almost all species have a shrubby habit, indicating that the study area is dominated by the shrubby Caatinga phytophysiognomy.

These 10 newly recorded species exemplify the importance of the environmental licensing process for documenting local and regional biodiversity. In contrast, the law project 3729/2004 and the Constitutional Amendment Proposal 65/2012 is a simplification and weakening of environmental laws, which will allow the devastation of natural areas caused by the expansion of agricultural areas, for example. Agriculture is the main driver of land conversion (Magrin et al. 2014) and has been the responsible for the loss of many ecosystems in the Cerrado domain (Overbeck 2015).

Our results contribute to the knowledge of the flora of Brazil and in particular of Rio Grande do Norte; these data help improve the distributional maps of 10 species. Additionally, these new records were gathered as part of an environmental consultancy prior to the establishment of a wind farm, which highlights the importance of accurate fieldwork and identifications. When done by specialized environmental consultants, such careful work is expected to guide the decisions of environmental agencies during the licensing. While we cannot assure the future of these species or the populations that we recently documented, in the face of changes to environmental laws by members of Congress, even such notice of novel occurrence may be lacking in the near future. It is also worthwhile to note that professional work of environmental consultants can contribute to the documentation of the flora of an area, but this also depends on well-curated herbarium collections, which can increase the detail of environmental studies and facilitate the consultation of professionals.

Some of the species presented here had already existed in the UFRN herbarium. However, as discussed by Versieux et al. (2017), small herbaria collections tend to receive less specialist visitors and unless the complete collection has been digitalized or duplicates are donated to specialists in other herbaria, it is difficult to keep

identifications up-to-date. The time-lag between the collection of specimens and the naming of new plant species was discussed by Fontaine et al. (2012), but the same process may affect any plant inventory or checklist; that is, specimens already deposited in herbaria but may take years before they are identified. Here, we call attention to specialists for additional new occurrences that could not be verified in the present work. Such potential new occurrences have been found in databases but have not been confirmed by the examination of herbarium specimens and are cited here only to call specialist's attention, since such occurrence are still missing in the Flora of Brazil 2020 website. One might argue that publicizing new occurrence in a case like ours does not assure species conservation, because land use changes are expected to take place quickly in the habitat. However, the specimen itself has value as a testimony of the original vegetation and as source of genetic material and other applications (Funk 2003). The distributional pattern seen here for the species documented here show broad occurrences in other neighboring states, and we believe that these species may be found in other Caatinga areas of Rio Grande do Norte with increased sampling. Although privately funded floristic inventories may be done quickly and overlook distinctions in floristic compositions, which can lead to the loss of relevant data (Versieux et al. 2011), our results show otherwise. Rapid floristic inventories may help increase the floristic knowledge of a given area, aid in conservation decisions, and provide more precise information on rare species if the work is careful and collection is done properly and identifications verified by experts or compared with herbarium specimens.

Acknowledgements

We are grateful to the experts Dr Cíntia Kameyama and MS Alan de Araújo Roque (Acanthaceae), Dr Luisa Ramos Senna Souza (Amaranthaceae), MS Márcio Lucas Bazante de Oliveira (Annonaceae), MS Thales Silva Coutinho (Apocynaceae), Dr Nadia Roque (Asteraceae), Dr Maria Iracema Bezerra Loiola (Combretaceae), Dr Letícia Ribes de Lima (Euphorbiaceae), and Dr Luciano Paganucci de Queiroz (Fabaceae) for confirming the determination of the species and to Eduardo Calisto Tomaz for proofreading the text. We thank PRH-51/ANP, Re flora/CNPq, and FAPERN/CAPES for granting of master's scholarships to the first, second, and third authors, respectively. The senior author thanks CNPq for his productivity grant. We thank the editors Guilherme Seger and Felipe Moreira and 3 anonymous reviewers for their constructive comments, which helped us to improve the manuscript. MS Alan de Araújo Roque is particularly acknowledged for his great contribution collecting and depositing specimens of Rio Grande do Norte Caatinga in UFRN herbarium.

Authors' Contributions

EOM, VFS and ASS collected the data and identified the species. All the authors analyzed the data and wrote the text.

References

- Abílio FJP (2010) Bioma Caatinga, ecologia, biodiversidade, educação ambiental e práticas pedagógicas. Editora Universitária da UFPB, João Pessoa, 196 pp.
- Araújo A, Alves M (2013) *Aristolochia setulosa* (Aristolochiaceae), a new species from northeastern Brazil. *Brittonia* 65 (3): 301–304. <https://doi.org/10.1007/s12228-012-9292-7>
- Bentham G (1840) Contributions towards a flora of South America—enumeration of plants collected by Mr. Schomburgk in British Guiana. *Journal of Botany* 2 (10): 38–103.
- BFG (2015) Growing knowledge: an overview of Seed Plant diversity in Brazil. *Rodriguésia* 66: 1085–1113. <https://doi.org/10.1590/2175-7860201566411>
- Brasil, Ministério do Meio Ambiente (2013) Bioma Caatinga. <http://www.mma.gov.br/biomas/Caatinga>. Accessed on: 2016-4-1.
- Brasil, Projeto de Lei 3729/2004 (2016a) Dispõe sobre o licenciamento ambiental, regulamenta o inciso IV do § 1º do art. 225 da Constituição Federal e dá outras providências. http://www.camara.gov.br/proposicoesWeb/prop_mostrarintegra?codteor=225810&filename=PL+3729/2004. Accessed on: 2016-7-10.
- Brasil, Proposta de Emenda Constitucional 65/2012 (2016b) Acrescenta o § 7º ao art. 225 da Constituição Federal, para assegurar a continuidade de obra pública após a concessão da licença ambiental. <https://www25.senado.leg.br/web/atividade/materias/-/materia/109736>. Accessed on: 2016-4-2.
- Candolle ALPP (1844) Apocynaceae. In: De Candolle AP, de Candolle ALPP (Eds.) *Prodromus systematis naturalis regni vegetabilis*. Pars 8. Treuttel & Würtz, Paris, 684 pp.
- Côrtes ALA, Rapini A (2013) Justicieae (Acanthaceae) do Semiárido do Estado da Bahia, Brasil. *Hoehnea* 40: 253–292. <https://doi.org/10.1590/S2236-89062013000200003>
- Dietrich D (1840) *Combretum* Loebl. In: *Synopsis Plantarum* 2: 1302–1303.
- Drummond J, Barros-Platiau AF (2006) Brazilian environmental laws and policies, 1934–2002: a critical overview. *Law & Policy* 28 (1): 83–108. <https://doi.org/10.1111/j.1467-9930.2005.00218.x>
- Flora do Brasil 2020 (2017) Rio de Janeiro Botanical Garden. <http://floradobrasil.jbrj.gov.br/>. Accessed on: 2017-8-5.
- Fontaine B, Perrard A, Bouchet P (2012) Twenty-one years of shelf life between discovery and description of new species. *Current Biology* 22: R943–R944. <https://doi.org/10.1016/j.cub.2012.10.029>
- Fries RE (1931) Revision der Arten einiger Anonaceen-Gattungen II. *Acta Horti Bergiani* 10: 129–341.
- Funk V (2003) 100 Uses for an herbarium (well at least 72). *ASPT Newsletter* 17 (2): 17–19.
- Garcia LC, Ellovitch MF, Rodrigues RR, Brancalion PH, Hatsumoto MH, Garcia FC, Loyola R, Lewinsohn TM (2016) Análise científica e jurídica das mudanças no Código Florestal, a recente lei de proteção da vegetação nativa. *ABECO*, Rio de Janeiro, 43 pp.
- Gardner G (1847) *Flora of Brazil*. London *Journal of Botany* 6: 417–463.
- JBRJ (Instituto de Pesquisas Jardim Botânico do Rio de Janeiro) (2016) Jabot - Banco de Dados da Flora Brasileira. <http://jabot.jbrj.gov.br/>. Accessed on: 2016-8-5.
- Junikka L, Maas PJM, Maas-van de Kamer H, Westra LYT (2016) Revision of *Oxandra* (Annonaceae). *Blumea* 61: 215–266. <https://doi.org/10.3767/000651916X694283>
- Kinoshita LS, Marcondes-Ferreira W, Rio MC, Sales MF, Simões AO (2005) Apocynaceae. In: Wanderley MGL, Shepherd GJ, Melhem TS, Martins SE, Kirizawa M, Giulietti AM (Eds) *Flora fanero-*

- gâmica do estado de São Paulo vol. 4. RiMa, São Paulo, 35–91
- Koch I, Rapini A, Simões AO, Kinoshita LS, Spina AP, Castello ACD (2015) Apocynaceae. In: Lista de Espécies da Flora do Brasil. Jardim Botânico do Rio de Janeiro. <http://floradobrasil.jbrj.gov.br/jabot/floradobrasil/FB4598>. Accessed on: 2016-8-5
- Lindau G (1905) Acanthaceae Americanae IV. Bulletin de l'Herbier Boissier (série 2) 5: 367–374.
- Loiola MIB, Sales MF (1996) Estudos taxonômicos do gênero *Combretum* Loeffl. (Combretaceae R. Br.) em Pernambuco – Brasil. Arquivos do Jardim Botânico do Rio de Janeiro 34 (2): 173–188.
- Lourenço ARL, Amorim BS, Alves M (2013) *Eugenia pipensis*, a new species sect. *Umbellatae* (Myrtaceae) from northeastern Brazil. Phytotaxa 104 (1): 30–34. <https://doi.org/10.11646/phytotaxa.104.1.4>
- Magalhães R, Versieux LM, Calvente A (2014) *Aechmea muricata* (Arruda) L.B.Sm. (Bromeliaceae: Bromelioideae): a new Record of a threatened species for Rio Grande do Norte, northeastern Brazil. Check List 10 (2): 434–435. <https://doi.org/10.15560/10.2.434>
- Magrin GO, Marengo JA, Boulanger JP, Buckeridge MS, Castellanos E, Poveda G, Scarano FR, Vicuña S (2014) Central and South America. In: Barros VR, Field CB, Dokken DJ, Mastrandrea MD, Mach KJ, Bilir TE, Chatterjee M, Ebi KL, Estrada YO, Genova RC, Girma B, Kissel ES, Levy AN, MacCracken S, Mastrandrea PR, White LL (Eds) Climate Change: Impacts, Adaptation and Vulnerability. Part B: Regional Aspects. Contribution of Working Group II to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change. Cambridge University Press, Cambridge, 1499–1566.
- Marquete N, Loiola MIB (2015) Combretaceae. In: Lista de Espécies da Flora do Brasil. Rio de Janeiro Botanical Garden. <http://floradobrasil.jbrj.gov.br/jabot/floradobrasil/FB6898>. Accessed on: 2016-8-6.
- Martius CFP (1826) Nova genera et species plantarum Brasiliensium. 2. Typis C. Wolf, Monachii, 148 pp.
- Martius CFP (1828) *Euphorbia* L. In: Spix JB, Martius CFP (Ed.) Reise Brasilien 2: 479.
- Martius, CPF (1841) Herbarium Florae Brasiliensis. Plantae brasilienses exsiccatae, quas denominatas, partim diagnosi aut observationibus instructas Botanophilis offert Dr. C. Fr. Ph. de Martius. Monachii. Flora 24 (2, Beibl. 2): 1–112.
- Martius CFP (1847) Acanthaceae. In: Martius CFP, Eichler AG, Urban I (Eds) Flora Brasiliensis. 9: 1–164. F. Fleischer, Lipsiae
- Moro MF, Nic Lughadha E, Filer DL, Araújo FS, Martins FR (2014) A catalogue of the vascular plants of the Caatinga Phytogeographical Domain: a synthesis of floristic and phytosociological surveys. Phytotaxa 160 (1): 1–118. <https://doi.org/10.11646/phytotaxa.160.1.1>
- Overbeck GE, Vélez-Martin E, Scarano FR, Lewinsohn TM, Fonseca CR, Meyer ST, Müller SC, Ceotto P, Dadalt L, Durigan G, Ganade G, Gossner MM, Guadagnin DM, Lorenzen K, Jacobi CM, Weisser WW, Pillar VD (2015) Conservation in Brazil needs to include non-forest ecosystems. Diversity and Distributions 21: 1455–1460. <https://doi.org/10.1111/ddi.12380>
- Peel MC, Finlayson BL, McMahon TA (2007) Updated world map of the Köppen-Geiger climate classification. Hydrology and Earth System Sciences 11 (5): 1633–1644. <https://doi.org/10.5194/hess-11-1633-2007>
- Profice SR, Kameyama C, Côrtes ALA, Braz DM, Indriunas A, Vilar T, Pessoa C, Ezcurra C, Wasshausen D (2015) Acanthaceae. In: Lista de Espécies da Flora do Brasil. Rio de Janeiro Botanical Garden. <http://floradobrasil.jbrj.gov.br/jabot/floradobrasil/FB15341>. Accessed on: 2016-8-6.
- QGIS Development Team (2017) QGIS Geographic Information System. Open Source Geospatial Foundation Project. <http://www.qgis.org/>. Accessed 2017-9-20.
- Queiroz LP (2015) *Bionia*. In: Lista de Espécies da Flora do Brasil. Rio de Janeiro Botanical Garden. <http://floradobrasil.jbrj.gov.br/jabot/floradobrasil/FB103546>. Accessed on: 2016-8-5.
- Ribeiro ARO, Alves M, Oliveira RC (2015) A new species of *Cyperus* L. (Cyperaceae) from northeastern Brazil. Phytotaxa 204 (2): 153–158. <https://doi.org/10.11646/phytotaxa.204.2.6>
- Riina R, Marques O, Hurbath F (2015) *Euphorbia* from Brazil: the succulent section *Brasilienses*. Euphorbia World 11 (3): 5–11.
- Saavedra MM (2011) Sistemática de *Dasyphyllum* (Asteraceae). PhD thesis. Instituto de Pesquisas Jardim Botânico do Rio de Janeiro/Escola Nacional de Botânica Tropical, Rio de Janeiro, 247 pp.
- Saavedra MM (2015) *Dasyphyllum*. In: Lista de Espécies da Flora do Brasil. Rio de Janeiro Botanical Garden. <http://floradobrasil.jbrj.gov.br/jabot/floradobrasil/FB5291>. Accessed on: 2016-8-4.
- Sampaio EVSB, Sampaio Y, Vital T, Araújo MSB, Sampaio GR (2003) Desertificação no Brasil: conceitos, núcleos e tecnologias de recuperação e convivência. Editora Universitária da UFPE, Recife, 202 pp.
- Senna LR, Giulietti AM, Rapini A (2010) Flora da Bahia: Amaranthaceae – Amaranthoideae e Gomphrenoideae. Sitientibus Série Ciências Biológicas 10 (1): 3–73.
- Senna LR, Siqueira JC, Marchioretto MS (2015) *Gomphrena*. In: Lista de Espécies da Flora do Brasil. Rio de Janeiro Botanical Garden. <http://floradobrasil.jbrj.gov.br/jabot/floradobrasil/FB4317>. Accessed on: 2016-8-3.
- Soares AS, Pastore JFB, Jardim JG (2017) New records, conservation assessments and distribution of Lamiaceae in Rio Grande do Norte state, northeastern, Brazil. Journal of the Botanical Research Institute of Texas 4 (1): 133–158. <https://doi.org/10.11646/phytotaxa.311.1.4>
- Sousa VF, Versieux LM (2016) Notes on the ornamental potential and taxonomy of *Justicia* (Acanthaceae, Justicieae), including a first record for the Paraíba flora, Brazil. Phytotaxa 270 (3): 203–209. <https://doi.org/10.11646/phytotaxa.270.3.4>
- Souza AF, Garda AA, Cestaro LA (2012) Riscos e ameaças na reforma do Código Florestal. Scientific American Brasil 122: 46–51.
- Stace CA (2010) Combretaceae. Flora Neotropica 107. The New York Botanical Garden Press, New York, 369 pp.
- Steinmann V, Caruzo MBR, Silva OLM, Riina R (2016) *Euphorbia*. In: Lista de Espécies da Flora do Brasil. Rio de Janeiro Botanical Garden. <http://floradobrasil.jbrj.gov.br/jabot/floradobrasil/FB17561>. Accessed on: 2016-8-7.
- Terra-Araújo MH, Faria AD, Alves-Araújo A, Alves M (2013) *Pradosia restingae* sp. nov. from the Atlantic Forest, Brazil. Nordic Journal of Botany 31: 437–441. <https://doi.org/10.1111/j.1756-1051.2012.01724.x>
- Thiers B (2018) Index Herbariorum: A global directory of public herbaria and associated staff. The New York Botanical Garden. <http://sweetgum.nybg.org/science/ih/>. Accessed on: 2016-4-4.
- Velloso AL, Sampaio EVSB, Pareyn FGC (2002) Ecorregiões: Propostas para o bioma Caatinga. Associação Plantas do Nordeste, Instituto de Conservação Ambiental, The Nature Conservancy do Brasil, Recife, 76 pp.
- Versieux LM, Dávila N, Delgado GC, de Sousa VF, de Moura EO, Figueiras T, Alves MV, Carvalho E, Piotto D, Forzza RC, Calvente A, Jardim JG (2017) Integrative research identifies 71 new plant species records in the state of Rio Grande do Norte (Brazil) and enhances a small herbarium collection during a funding shortage. PhytoKeys 86: 43–74. <https://doi.org/10.3897/phytokeys.86.13775>
- Versieux LM, Medeiros MCMP, Spósito TCS, Stehmann JR (2011) Characterization of three component in a semideciduous forest in the Espinhaço Range: a subsidy to conservation. Caatinga 24 (2): 85–94.
- Versieux LM, Tomaz EC, Jardim JG (2013) New genus and species records of Bromeliaceae in the Caatinga of Rio Grande do Norte state, northeastern Brazil: *Orthophytum disjunctum* L.B.Sm. (Bromelioideae) and *Tillandsia paraibensis* R.A.Pontes (Tillandsioideae). Check List 9 (3): 663–665. <https://doi.org/10.15560/9.3.663>
- Wasshausen DC, Wood JRI (2004) Acanthaceae of Bolivia. Contributions from the United States National Herbarium 49: 1–152.